Radiation

Restore the River Corridor • Transition the Central Plateau • Prepare for the Future

What is radiation?

Radiation is a form of energy produced by the radioactive decay of atoms. It may be emitted as particles, such as alpha; beta; as neutrons, or as pure energy, such as gamma rays or x-rays.

Alpha particles

Alpha particles are the heaviest and have very little penetrating ability. They can travel only a few inches in the air, and can't get through a sheet of paper or the outer layer of a person's skin. Alpha particles are only hazardous if inhaled, swallowed, absorbed, or injected. At Hanford, they can be found at facilities such as the Plutonium Finishing Plant (PFP) and the Central Waste Complex (CWC).

Beta particles

Beta particles are more penetrating than alpha particles and can travel a few feet in the air. Beta particles can pass through a sheet of paper, or thin clothing, but are stopped by a thin sheet of aluminum foil or glass. Beta particles can penetrate into and damage skin, but pose the greatest risk if swallowed, inhaled, absorbed or injected. Hanford's beta particle radiation is most likely found in the site's nuclear reactors, spent nuclear fuel facilities (K Basins), processing facilities (e.g. U Plant, T Plant, and the Plutonium Uranium Extraction Plant) and low-level and mixed low-level waste.

Neutrons

Neutrons are particles emitted from the splitting, or fissioning, of certain types of atoms like plutonium. Neutrons can be very penetrating and are an external hazard. They are usually shielded using concrete, water, or thick sheets of plastic. Facilities associated with plutonium production, such as the PFP, and certain types of transuranic waste, are where you'll find them most concentrated at Hanford.

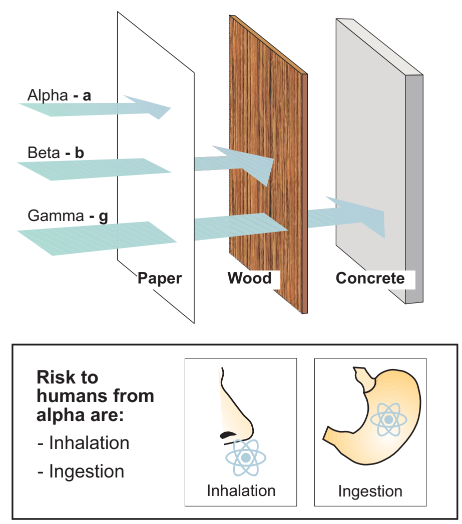
Gamma rays

Gamma rays are pure energy, typically emitted simultaneously with beta particles and occasionally with alpha particles or neutrons. Gamma rays are extremely penetrating and are also an external hazard. Thick layers of concrete, lead, steel, or water can be used to stop penetration of gamma rays. At Hanford they can be found in facilities such as T Plant, U Plant, B Plant, and the tank farms.

X-rays

X-rays are essentially identical to gamma rays, but generally have less energy. Therefore, x-rays are less penetrating than gamma rays and require less shielding. X-rays at Hanford are often emitted simultaneously with alpha particles. X-rays are most likely found where alpha particles exist, such as PFP and CWC.

Example Barriers to Radiation Forms



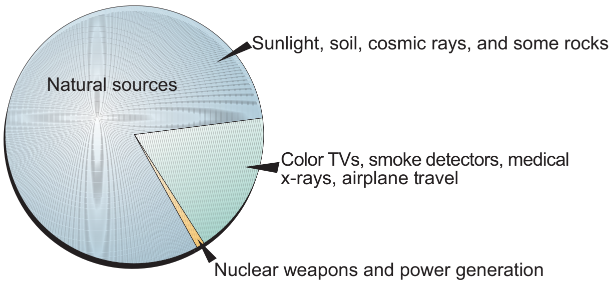
How is radiation measured?

A radiation dose is measured in units of rems or millirems (1 millirem = 1/1000th of a rem). The unit of rem is a standard measurement of the potential biological effect on humans from a given dose regardless of the type, intensity, or duration of the radiation exposure. For example, one rem of dose due to external exposure to gamma rays is equivalent to one rem of dose due to internal exposure to alpha particles.

How much radiation do people typically receive annually?

The average person in America receives an annual radiation dose of about 360 millirems, including roughly 300 millirems from natural sources and 60 from manmade sources (primarily medical x-rays). It is not uncommon for people to receive more than the average annual dose due to a variety of other factors, such as airplane travel, dental and medical x-rays, and occupational conditions, such as working in radiological imaging or nuclear medicine departments of a hospital.

Background Radiation



Natural radiation

Naturally occurring radiation is present in the environment, and we are all constantly exposed to it. The three primary sources of natural radiation are: 1) terrestrial radiation from soil and soil gases; 2) cosmic radiation from the sun and outer space; 3) and internal radiation due to naturally occurring radioactivity in the body. Natural terrestrial radiation depends upon location. For example, people living or working in areas with granite or other mineralized rocks receive more terrestrial radiation than average. Exporure to cosmic radiation varies with altitude; people living at higher altitudes receive more. Internal radiation due to naturally occurring radioactivity in the body can vary depending upon an individual's diet, and the sources of his/her food and water. The average person in this country receives an annual dose of about 300 millirem, (over 80 percent of the total radiation dose received by the average person) from these natural sources, also known as "background radiation."

Manmade sources of radiation

People are also exposed to radiation from numerous manmade sources. Medical uses account for the vast majority, but small amounts of exposure are received from consumer products such as televisions, smoke detectors, and natural gas heating. Manmade sources account for about 20 percent -- or 60 millirem -- for an average person on an annual basis.

Examples of typical doses due to radiation exposure from various activities:

- Receiving a standard chest x-ray - 2 millirems
- Receiving a full body CAT scan - 1,000 millirems (1 rem)
- Taking a 5-hour transcontinental jet flight - 3 millirems
- Living in Denver, CO vs. Seattle, WA - 45 millirems
- Living directly outside a nuclear power facility - about 1 millirem per year
- Waiting at a stoplight in a car next to a truck carrying nuclear waste - less than one-half of a millirem
- Sitting on a park bench as a truck carrying nuclear waste passes by - less than one-tenth of a millirem
- Working in a nuclear power plant - 210 millirems (an occupational dose)
- Working at a DOE nuclear facility - 74 millirems (an occupational dose)
- Visiting the Hanford spent nuclear fuel project and walking over the K Basin fuel pools - 1.2 millirems

Radiation at Hanford

Materials or sites at Hanford that are considered radiologically "contaminated" contain radioactive material located in a place where it isn't wanted (as opposed to radioactive fuel in a nuclear reactor). Radiological contamination at Hanford exists as a result of plutonium production during and after World War II, and subsequent cleanup activities since production halted in the 1980s. As the U.S. Department of Energy (DOE) and its contractors work to cleanup the site, additional waste is created when tools, clothing, and other debris become contaminated.

Because radiation is present in many areas at the Hanford Site, DOE restricts public access. DOE and its contractors use extensive administrative controls such as training, shielding, and operating procedures to protect humans and the environment from the possible harmful effects of radiation exposure. When radioactive materials leave the Hanford Site, workers ensure the material is properly shielded in specialized shipping containers.

For more information

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Or contact us on our INTERNET home page at *http://www.hanford.gov*